ARIZONA DEPARTMENT
OF
ENVIRONMENTAL QUALITY

Douglas A. Ducey
Governor

Misael Cabrera
Director

via e-mail

October 16, 2017
FPU18-087

Ms. Catherine Jerrard
AFCEC/CIBW
706 Hangar Road
Rome, NY 13441

RE: WAFB – ADEQ comments - *Draft, Soil Vapor Extraction System/Steam Enhanced Extraction System, Operation and Maintenance, 2016 Second Quarter Performance Report, Former Liquid Fuels Storage Area, Site ST012, Former Williams Air Force Base, Mesa, Arizona*; prepared for Air Force Civil Engineer Center (AFCEC/CIBW), Lackland AFB, TX; prepared by Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec), Phoenix, AZ; document dated August 29, 2017.

Dear Ms. Jerrard:

Arizona Department of Environmental Quality (ADEQ) Federal Projects (FP) personnel and ADEQ contractor UXO Pro, Inc. reviewed the above referenced document. ADEQ's comments are presented below and on following pages.

General Comments

GC 1: ADEQ remains concerned that contaminants mobilized during Steam Enhanced Extraction (SEE) remedial activities were not captured and may have migrated away from the site. In addition, data collected during the time period of the report indicate a significant mass of contaminant remained within or proximate to the thermal treatment zone. ADEQ communicated on multiple occasions a recommendation to continue SEE, or at a minimum, after steam injection ceased, to continue vapor and liquid extraction from the treatment zone for an extended period of time (i.e., months or years). Steam injection was ceased on March 4, 2016 and was not re-started during the current reporting period. Vapor and liquid extraction were terminated on April 29, 2016 despite the requests of ADEQ to continue until mass extraction rates and contaminant concentrations met transition criteria for enhanced bioremediation (EBR).

GC 2: The criteria for transitioning from SEE to EBR provided in Table 4-2 of the May 2014 Work Plan have not been met based on the data provided in the subject report. Of the five criteria discussed, only two criteria remain relevant: diminishing mass extraction rates (less than 10% of peak rates during SEE) and benzene groundwater concentrations less than 500 µg/L.

GC 3: Please ensure that all laboratory analytical reports from the reporting period are included in the appropriate appendices, including reports from both TestAmerica Phoenix and Denver laboratories.

Specific Comments

1. Page 1-3, Section 1.3.1, Line 261. Please edit the text to read "removed approximately 344,000 gallons of fuel contamination."
2. Page 2-3, Table 2-2. The table indicates the average flow rate into the oxidizer was roughly double during the reporting period as compared to the previous period. Please explain the origin for the additional flow. Deep SVE wells were not incorporated until mid-May 2016 when the oxidizer was converted to thermal mode. The addition of the deep wells appears to have lowered the average concentration and the mass removal rate, as presented in Table 2-2, despite the relatively high concentration for these wells as presented in Table 2-6.
3. Page 2-8, Table 2-6. Please provide an explanation for the following discrepancy noted between Tables 2-6 and 2-2, as the results suggest the PID and FID readings are unreliable. The average laboratory influent concentration TPH as JP-4 is reported in Table 2-2 to decrease from 4,500 ppmv in the previous quarter to 1,730 ppmv in the reporting period. However, the wellfield oxidizer influent average VOC concentration based on FID and PID readings reported in Table 2-6 indicate an increase in concentration.
4. Page 2-9, Table 2-7. Please consider adding a column for the average extraction rate from open wells.
5. Page 2-12, Section 2.2.1.2, line 598. As with comment 2 above, please explain how the average flow rate is double in the current reporting period compared to the previous period.
6. Page 2-17, Section 2.3.1. Please explain how the increase in flow and the addition of deep SVE wells with high TPH concentrations (see Table 2-8) resulted in a lower mass extraction rate during the reporting period. Additionally, please explain how the collapse of the steam bubble resulted in a lower oxidizer influent concentration.
7. Page 2-19, Section 2.3.2, line 779. Is the cited concentration of 760 ppmv correct? If so, what is the source? The value presented in Table 2-2 is 1,730 ppmv.
8. Page 3-6, Section 3.2.1. Please add a sub-section discussing the groundwater analytical results for CZ, UWBZ, and LSZ wells collected in June 2016 and include a separate appendix with the associated laboratory analytical reports.
9. Page 3-8, Section 3.2.1.2.1. Are continuous logs of vapor flow rate from the wellfield available? Line 982 states "Vapor flow rate is continuously logged at the vapor extraction blower discharge to monitor the wellfield vapor extraction rate." However, line 988 states "The wellfield flow rate is calculated by taking the daily average flow rate to the thermal accelerators and subtracting the air stripper effluent flow rate to estimate the vapor flow from the wellfield."
10. Page 3-9, Section 3.2.1.2.1, Line 988. Please explain why a pitot tube was not installed to measure directly the wellfield flow exiting the vapor cooling process. The vapors from the wellfield carried a vast majority of the non-NAPL mass extracted during this period making direct measures of the wellfield flow and concentrations of primary importance for evaluating SEE performance.
11. Page 3-10, Section 3.2.1.2.2, lines 1013-1014. Please edit the sentence to read, "Graph 3-5 shows the groundwater extraction rate by treatment zone since system start-up."
12. Page 3-31, Section 3.2.1.3.3. The utility of the method used to calculate benzene concentrations is questionable and certainly qualitative. As stated, variability in the calculated concentrations was observed and attributed to the identified flow measurement errors and to a lesser extent on variability in the feedwater concentration. However, the text should also mention the variability in the analytical results for the concentrations as laboratory data are only accurate to about +/-30% and only reported to two significant digits. As evidenced by the calculation of negative values, the calculated concentrations are unreliable and cannot be used to support the transition from SEE to EBR. Measures of the benzene concentration in the air stripper influent provide a more consistent and reliable indicator of cleanup progress.

13. Page 3-31, Section 3.2.1.3.3. On the right side of the equation, $C_{formation}$ should be replaced with C_{return}.
14. Page 3-33, Section 3.2.1.4. Please include a discussion of the pump intake depths in relation to the water table drawdown in the jar test wells. The MPE well jar testing is qualitative and provides little value in assessing system performance. A primary determinant in the recovery of LNAPL from these wells is the depth of the pump intake in relation to the water table drawdown within the well. For example, a relatively deep pump placement can allow a very large volume of LNAPL to collect at the water table surface with very little LNAPL extraction by the pump.
15. Page 3-51, Section 3.3.1.1. Please include a more detailed discussion regarding the reliability of the thermocouples and associated effects on the interpretation of subsurface temperatures. As discussed in BCT meetings during the reporting period, many of the thermocouples utilized to calculate average subsurface zone temperatures were erratic and many readings were unreliable. With respect to progress toward attaining remedial goals, attaining target temperatures is a prerequisite for desired SEE performance but is not an indicator of SEE duration to attain remedial goals. Hence, this criterion for transition to EBR is irrelevant.
16. Page 3-56, Section 3.3.1.3, Line 1433. Please include a discussion regarding the following data taken from Table 3-11. The Mass Removed as Vapor from the Wellfield on an average daily basis in the reporting period (3,359 lbs/day) was more than double the average during the previous reporting period (1,284 lbs/day) and higher than the average during operations since startup of SEE (1,978 lbs/day). Although LNAPL recovery may have declined, the average total mass removal rate in the reporting period was higher than in the previous reporting period. This increase is also evident in Graphs 3-17 and 3-18.
17. Page 3-57, Section 3.3.1.3, Line 1465. Please edit the sentence to read, "Mass removal (combined LNAPL and vapor at the thermal accelerators) peaked on 14 May 2015 based on PID readings." Please add a sentence describing the peak mass removal rate based on analytical data and a comparison of this value to rates calculated for the current period. No evaluation has been provided describing the quality of correlations between PID readings and analytical data. Site decisions should rely upon certified analytical data.
18. Page 3-57, Section 3.3.1.3, Line 1466. Please edit to read "Graph 3-19 shows the mass removal over time as a percent of peak removal based on PID readings."
19. Page 3-57, Section 3.3.1.3. Please add a second graph similar to Graph 3-19 that shows the mass removal over time as a percent of peak removal based on analytical data.
20. Page 3-57, Section 3.3.1.3, Line 1468. Delete the phrase, "… demonstrating achievement of the transition criteria." The statement that mass removal rates at the end of the reporting period were slightly less than the previous reporting period is contradicted by the data in Table 3-11 and as described in comment 16 above. Hence, the data do not demonstrate achievement of the transition criteria for diminished mass removal rate.
21. Page 3-58, Section 3.3.1.4 and Table 3-12. Please revise Table 3-12 to include all of the benzene data from the reporting period and re-write the section based on the full data set available. The benzene data summarized in the table appears to be incomplete with respect to the available analytical data. Other analyses have been provided for air stripper influent samples collected during the reporting period and were included in Table 3-4.
22. Page 3-59, Section 3.3.1.4. As described in previous comments, the methodology employed to obtain qualitative estimates of benzene concentrations in extraction wells is unreliable and insufficient monitoring exists to assess the origin of extracted mass. However, if considered, note that Table 3-5 suggests 10 of 13 wells in the CZ, 13 of 15 in the UWBZ, and 5 of 6 in LSZ exceed the transition criteria for benzene concentration. No statement can be made regarding the satisfaction of the benzene concentration criteria for transitioning to EBR using this methodology from any time in the process.

23. Page 3-59, Table 3-13, Target Temperature Achievement. As described in comment 15, this criterion for transitioning to EBR is irrelevant as it has no correlation to contaminant removal rates or concentrations. As such, it should be removed from the table.
24. Page 3-59, Table 3-13, Mass Removal Status. As described in comments 16 and 20, this criterion for transitioning to EBR has not been achieved and the mass removal rate increased during this period. Further, only certified analytical data should be used to evaluate the criterion since PID readings are field data and not suitable for making major site remedial decisions.
25. Page 3-59, Table 3-13, Pressure Cycling Status. As described in BCT discussions and comments on other documents, this criterion for transitioning to EBR has not been achieved. Increases in vapor concentrations associated with site-wide depressurization are not evident in the data and have not occurred. The pressure cycling criterion makes no mention of LNAPL mass removal rates in its description for satisfaction. Hence, this criterion is irrelevant for transitioning to EBR.
26. Page 3-60, Table 3-13, Benzene Concentrations. As described in comment 22, the methodology employed to obtain qualitative estimates of benzene concentrations in extraction wells is unreliable and insufficient monitoring exists to assess the origin of extracted mass. No statement can be made regarding the satisfaction of the benzene concentration criteria for transitioning to EBR using this methodology from any time in the process. Air stripper influent benzene concentration remains above the transition criteria indicating the criterion has not been satisfied.
27. Page 3-60, Section 3.3.2.1. Provide quantitative support for using a mass balance on water to assess containment during steam injection. As described in a previous ADEQ memo and in discussions during BCT meetings, a mass balance on water is inadequate to assess containment during steam injection, a multi-phase process. Steam vapors displace liquid water from soil pore space and this displaced water must be accounted for in assessing containment. Further, to maintain containment, the extensive heterogeneity at the site necessitates a ratio far in excess of one for the extraction rate compared to the injection rate, after accounting for displaced groundwater and natural groundwater flow. Operational periods occurred when the extraction rate was less than the injection rate and the steam zone was allowed to grow outward for a time. In addition, each of the zones above and below the LSZ should be evaluated separately for containment given the minimal hydraulic communication between the two. The pressure gradients associated with this outward growth can mobilize LNAPL outward; however, the subsequent pressure gradients when the extraction rate increased (or steam injection rate decreased) are much, much smaller and unlikely to mobilize the LNAPL back in.

Closure

ADEQ may add or amend ADEQ comments if evidence to the contrary of our understanding is discovered; if received information is determined to be inaccurate; if any condition was unknown to ADEQ at the time this document was submitted or electronically delivered; if other parties bring valid and proven concerns to our attention; or site conditions are deemed not protective of human health and the environment within the scope of this Department.

Thank you for the opportunity to comment. Should you have any questions regarding this correspondence, please contact me by phone at (602) 771-4121 or e-mail miller.wayne@azdeq.gov.

Sincerely,
Wayne Miller
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Remedial Projects Section, Waste Programs Division

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